

## Chapter 5

### Effects on children

#### 5.1 Preschool children's misbehaviours

Children in their nature demonstrate misbehaviours more or less. But some factors in their living environment can raise the frequency of misbehaviours. Hattori *et al.* (1986) pointed out aircraft noise was one of the factors reporting that the children around Komatsu Airport in Ishikawa Prefecture showed significantly higher rate of misbehaviours than those of the control.

In this section are reported the results of the survey conducted around the U.S. airfields in Okinawa with respect to children's misbehaviors and the results of their analysis in terms of aircraft noise exposure.

##### 5.1.1 Method

The questionnaire on children's misbehaviour is based on that developed by Kodama *et al.* (1982). It consists of 92 questions regarding "biological function," "social standard," "physical constitution," "movement habit" and "character." The questionnaires were distributed in nursery schools and kindergartens located in the areas with WECPNL over 75 around Kadena Air Base and Futenma Air Station from June to September 1996. The children living around Kadena Air Base were divided into four groups according to WECPNL at their residences of under 75, 75, 80, and over 85 and those around Futenma Air Station into three groups of WECPNL of under 75, 75 and 80.

The subjects were male and female preschool children, 3 to 6 years of age, whose parents and caregivers or teachers answered the questions. The respondents were only explained that the survey was conducted for the sake of the health care of preschool children and were not informed that the survey was a part of the investigation on the effects of aircraft noise. The total number of

**Table 5.1** The number of valid answers stratified by WECPNL and age

Age	Control	WECPNL								Total	
		-75		75-80		80-85		85-			
		K	F	K	F	K	F	K	F	K	F
3	48	15	70	43	36	35	20	60	0	153	126
4	79	30	109	88	61	71	27	91	0	280	197
5	106	32	77	127	117	104	65	113	0	376	259
6	75	9	28	37	39	28	16	32	0	106	83
Total	308	86	284	295	253	238	128	296	0	915	665

K: around Kadena Air Base, F: around Futenma Air Station

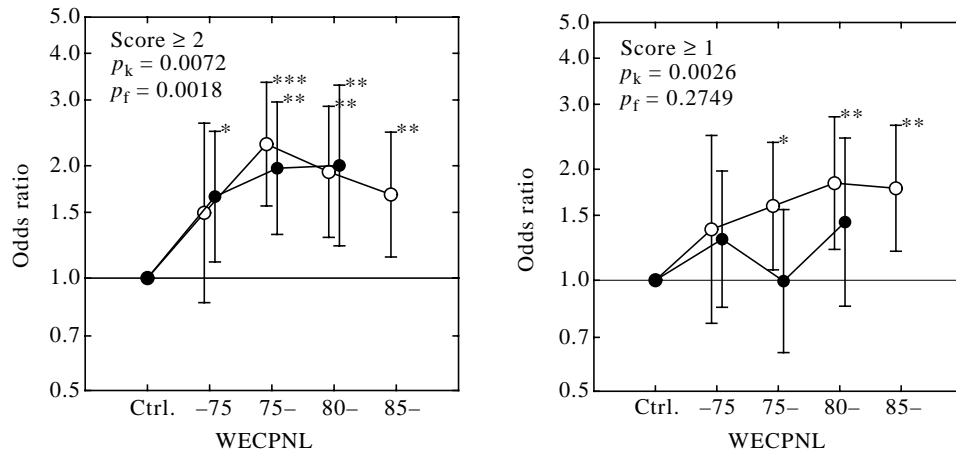
distribution was 2,391 among which the numbers of valid answers were 1,580 from the noise-exposed groups, 915 around Kadena Air Base and 665 around Futenma Air Station, and 308 from the control group. In this survey the control was taken from the southern part of the island where aircraft noise exposure was scarce. Table 5.1 shows the numbers of valid answers stratified by WECPNL and age.

### 5.1.2 Results and discussion

The answers are clustered by means of the cluster analysis into 17 clusters. These clusters are named (1) cold symptoms, (2) skin problem, (3) headache-stomachache, (4) excretory problem, (5) language problem, (6) eating problem, (7) habitual problem A, (8) habitual problem B, (9) injury-sickness, (10) interpersonal tension, (11) passive inclination, (12) fearsome inclination, (13) fatigue inclination, (14) adherence-anxiety, (15) emotional instability, (16) aggressiveness-disobedience, and (17) complaint-discontent.

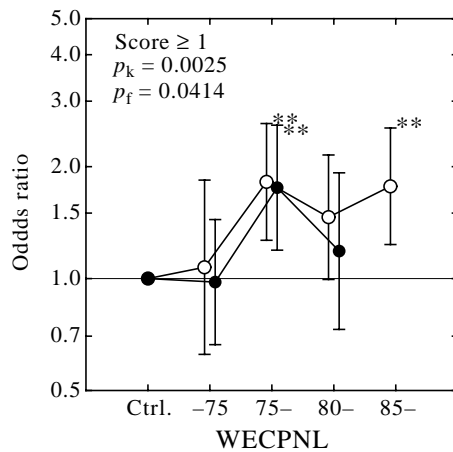
Multiple logistic regression analysis is conducted taking the each of cluster score as the dependent variable and “dose of noise exposure,” “age,” “sex,” “size of family,” “birth order,” “mother’s age at birth,” “father’s job,” and “mother’s job” as the independent variables. As is shown in Figure 5.1, it is found that the clusters showing the linear relation between the logarithm of odds ratio and WECPNL are “cold symptoms,” “headache-stomachache,” “eating problem,” “passive inclination” and “emotional instability” around Kadena Air Base, and “cold symptoms,” “eating problem,” and “passive inclination” around Futenma Air Station.

To put the above tersely, children living around airfields and habitually exposed to aircraft noise are likely to have the following inclinations: they easily catch cold, have a poor appetite, and take a long time to make friends.



(a) Cold symptoms.

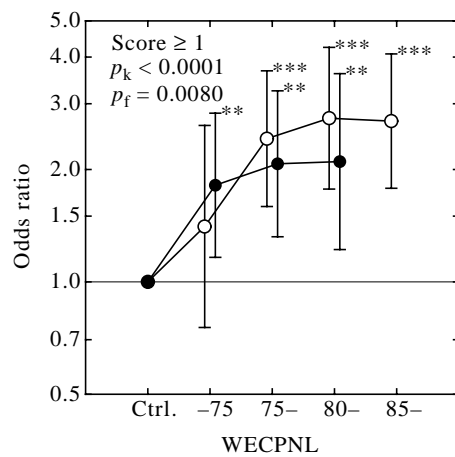
(b) Headache-stomachache.



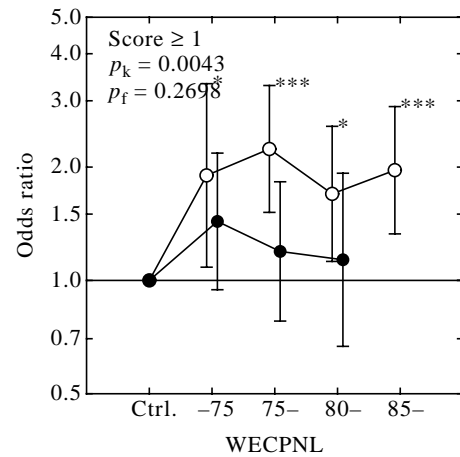
(c) Eating problem.

**Figure 5.1** Odds ratio *vs.* WECPNL on the clusters.

Open circles and solid circles show the odds ratios with the 95% confidence intervals around Kadena Air Base and Futenma Air Station, respectively. The symbols  $p_k$  and  $p_f$  show the significance probabilities of the trend test. The asterisks show the significance probabilities of odds ratios to the control group (\*:  $p < 0.05$ , \*\*:  $p < 0.01$ , \*\*\*:  $p < 0.001$ ).



(d) Passive inclination.



(e) Emotional instability.

**Figure 5.1** Odds ratio vs. WECPNL on the clusters (continued).

Open circles and solid circles show the odds ratios with the 95% confidence intervals around Kadena Air Base and Futenma Air Station, respectively. The symbols  $p_k$  and  $p_f$  show the significance probabilities of the trend test. The asterisks show the significance probabilities of odds ratios to the control group (\*:  $p < 0.05$ , \*\*:  $p < 0.01$ , \*\*\*:  $p < 0.001$ ).

**Table 5.2** Number of kindergartens and nursery schools in which interior air quality was measured

Vicinal base	Rate of children with higher score of cold symptoms	Num. of kindergartens and nursery schools
Kadena Air Base	$\geq 25\%$	8
	$< 15\%$	2
Futenma Air Station	$\geq 25\%$	3
	$< 15\%$	1
Control		4
Total		18

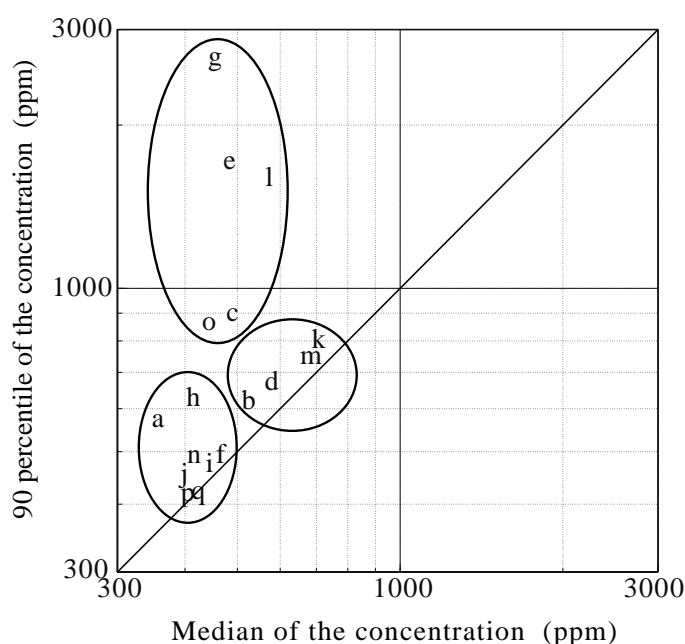
## 5.2 Interior air pollution and cold symptoms

The significance increase of odds ratios in the noise exposed groups found in the previous section might be attributed to possible interior air pollution in the classrooms around the bases where sound insulation programme is carried out by the government, in which case air conditioners are facilitated. It should be noted that, although windows are kept closed during the hours of air conditioning, it does not necessarily cause interior air pollution since well-designed air conditioning would operate ventilation as well.

### 5.2.1 Method

In the investigation reported in the previous section are found 14 nursery schools and kindergartens in which over 25% of the preschool children showed over 3 points of “cold symptoms.” Among the 14, 11 nursery schools and kindergartens, 8 around Kadena Air Base and 3 around Futenma Air Station, accepted the measurement of interior air quality of the classrooms. Measurement is also carried out in 3 nursery schools and kindergartens, two around Kadena air Base and one around Futenma Air Station, in which air conditioning is carried out and the rate of the children showing over 3 points of “cold symptoms” is less than 15%. In the control group four nursery schools and kindergartens, two with air conditioning and two without air conditioning, accepted the measurement. The total number of nursery schools and kindergartens attended the measurement is 18. In Table 5.2 tabulated the number of nursery schools and kindergartens where measurement was conducted.

The items of air quality measured are temperature, humidity, dust, carbon dioxide and carbon monoxide. The devices were composed by the



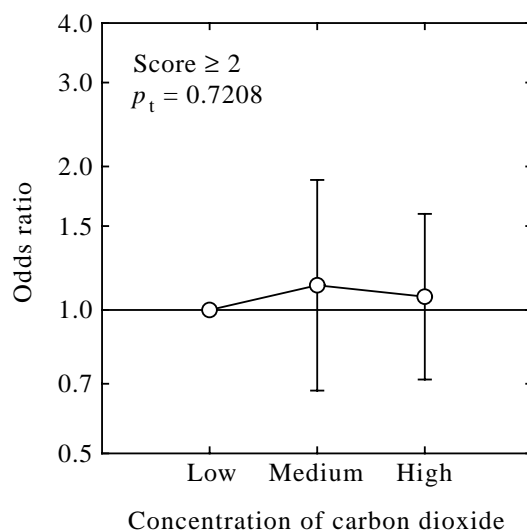
**Figure 5.2** Scattergram of the concentration of carbon dioxide  
 (a-i) Around Kadena Air Base  
 (j-m) Around Futenma Air Station  
 (n-q) Control

Institute for Science of Labour and have automatic measuring system.

### 5.2.2 Results

The result of the concentration of carbon dioxide is presented in Figure 5.2, because carbon dioxide is the standard indicator of air quality when the contamination is wondered due to the human activities. In the figure the result of a nursery school around Kadena Air Base is excluded because of the accident of measurement. The abscissa of the figure is median of the concentration and the ordinate is its 90 percentile. All the measurements plotted in the figure are undertaken during the class hours with the children inside and windows closed. The nursery schools and kindergartens having the median less than 500ppm and 90 percentile less than 850ppm are judged “good ventilation,” those having the median over 500ppm and 90 percentile less than 850ppm are judged “slightly poor ventilation” and those having the median over 500ppm and 90 percentile over 850ppm are judged “pretty poor ventilation.”

Multiple logistic regression model is applied with the scale score of “cold symptoms” as the dependent variable and air quality, noise exposure, age and sex as independent variables. The variable of air quality is dummy variable as



**Figure 5.3** Odds ratio *vs.* concentration of carbon dioxide on cold symptoms

Open circles show the odds ratios with the 95% confidence intervals. The symbol  $p_t$  is the significance probability of the trend test on the concentration of carbon dioxide.

categorized above. Figure 5.3 illustrates the relation between the odds ratio with respect to “cold symptoms” and the concentration of carbon dioxide adjusted for confounding factors. The vertical bars in the figure indicate the 95% confidence limits of the odds ratios. It is quite clear that the score of “cold symptoms” has little to do with the air quality in the classrooms as represented by the concentration of carbon dioxide or the ventilation of the rooms.

From the results it would be safe to say that the aircraft noise exposure is a factor of increasing the number of the preschool children’s physical and mental misbehaviours.

## References

- Hattori M, Kohno A, Taniguchi T, Morikawa K (1986), Increased incidence of behavior problems of preschool children in a noise polluted area, *J Hokuriku Public Health* 13(1), 30–38 (in Japanese).
- Kodama H, Nakamura T *et al.* (1982), *Shouni no Mondai Koudou (Preschool Children’s Misbehaviours)*, Ishiyaku Shuppan, Tokyo (in Japanese).